

Lagrangian Floats for Deep Convection

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LONG-TERM GOALS

I aim to understand the process of deep convection in the ocean.

OBJECTIVES

Near surface water is mixed to great depth at a few high latitude locations, thereby forming the deep and bottom masses of the ocean. This proposal has supported the development and deployment of neutrally buoyant floats in the Labrador Sea in the winters of 1997 and 1998 and the analysis of the resulting data. These floats provide detailed information on the processes and rates of deep convection. The objective during FY01 was to finish analysis of this data.

APPROACH



Lagrangian Floats (see figure) accurately follow water motions through a combination of a density which matches that of seawater and a high drag. The density is matched to that of the ambient water by actively changing the float's volume and will stay matched, despite changes in pressure and temperature, though a combination of active control and a hull compressibility which is close to that of seawater. High drag is achieved through a large circular cloth drogue attached to the float. The horizontal motion of the float is determined by acoustic tracking (RAFOS) and its vertical motion is determined from pressure. Data is relayed at the end of the 2-month mission via satellite (ARGOS). These data are supplemented by meteorological and oceanographic data from other investigators involved in the Labrador Sea Deep Convection experiment.

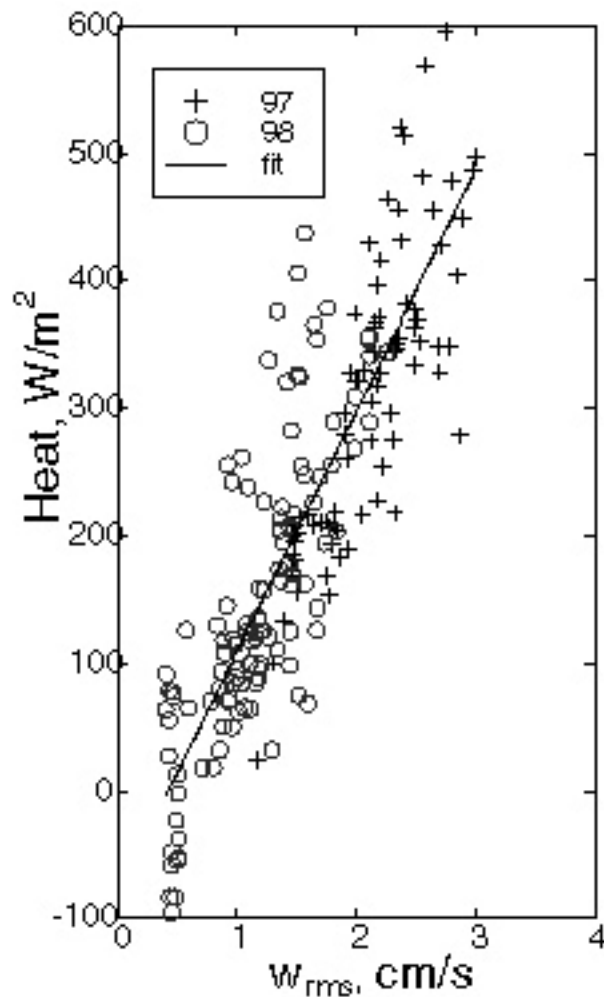
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WORK COMPLETED

Our data from both 1997 (13 floats) and 1998 (7 floats) has been completely processed and calibrated and most of the basic data analysis completed. Two papers have been accepted for publication in a special Labrador Sea Convection issue of the *Journal of Physical Oceanography*, one describing the floats and data and a second, with Ramsey Harcourt of NPS, comparing these with the predictions of an LES model. Much of this work was done by graduate student Elizabeth Steffen as part of her Ph.D. work.

RESULTS

The figure shows the strong correlation between vertical velocity as measured by the floats and the surface heat flux, from calibrated NCEP surface heat flux. This shows that mixing in the Labrador sea is really convection: it is driven by heat flux and is primarily vertical, not slant.



IMPACT/APPLICATIONS

These data have produced direct confirmation of the existing theoretical ideas about how the “rapid mixing” phase of deep convection works. This has direct implications for the parameterization of convective mixing in numerical models.

TRANSITIONS

None

RELATED PROJECTS

Relatives of these floats are being used in the ONR supported CBLAST study of hurricanes and in studies of circulation, upwelling and mixing off the Oregon Coast.

PUBLICATIONS

Harcourt et al. (2001), Fully Lagrangian floats in Labrador Sea deep convection: Comparison of Numerical and experimental results, J. Phys. Oceanogr., in press.

Steffen, E. and E. D'Asaro (2001), Deep convection in the Labrador Sea as observed by Lagrangian Floats, J. Phys. Oceanogr., in press